

Michael P. Ross (707) 362-3824
mpross2@uw.edu

Experimental physicist interested in a wide variety of precision measurement including gravitational wave observation, tests of gravity, and rotational seismology

Education

University of Washington	Seattle, WA
- Ph.D. Physics	2020
Dissertation: <i>Precision Mechanical Rotation Sensors for Terrestrial Gravitational Wave Observatories</i>	
- M.S. Physics	2017
Elective Coursework: quantum computing, machine learning, high performance computing, data analysis, seismology	
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Humboldt State University	Arcata, CA
- B.S. Physics	2015
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College of the Redwoods	Eureka, CA
- A.A. Science	2013
- A.A Science Exploration	2013

Research Experience

University of Washington	Seattle, WA
Center for Experimental Nuclear Physics and Astrophysics (CENPA) Eöt-Wash Experimental Gravity Group	
- Postdoctoral Scholar	July 2020 - Present
- Research Assistant	Jan 2017 - June 2020
- Laboratory Technician	Aug 2015 - Sep 2016

The Eöt-Wash group specializes in cutting-edge tests of gravity and searches for new physics utilizing precision mechanical systems (torsion balances and beam balances). I was involved in a wide-range of projects but focused on instrumentation for the LIGO gravitational wave observatories.

LIGO	Livingston, LA
Livingston Observatory	
- LIGO Scientific Collaboration Fellow	Feb 2018 - May 2018

As a LSC fellow, I built four precision ground rotation sensors and implemented the sensors in the observatory's seismic isolation system to correct the contamination of seismometer signals due to wind-driven tilts.

Humboldt State University	Arcata, CA
Gravity Lab	
- Undergraduate Researcher	Sep. 2013 - May 2015

The HSU Gravity Lab is constructing a torsion balance experiment to test both the inverse square law and equivalence principle. As a student researcher, I operated and maintained the apparatus, led the fabrication of the pendulum, the mechanical and electrostatic controls, and the in-vacuum attractor mass assembly.

Teaching Experience

University of Washington Seattle, WA
Department of Physics
- Directed Reading Instructor May 2019 – Dec 2019
- Teaching Assistant Sep 2016 – Dec 2016

Taught a one-on-one reading course for undergraduates that covered the basics of gravitational wave theory and contemporary subjects in gravitational wave astronomy. As a teaching assistant, I taught an algebra-based heat and electromagnetism lab and an introductory level calculus-based mechanics tutorial, assisted in exam grading for the introductory mechanics course, and tutored in an open lab study center.

Humboldt State University Arcata, CA
Department of Physics & Astronomy
- Lecturer Jan 2021 – May 2021
- Instructional Student Assistant Sep 2013 – May 2015

Remotely taught an upper division modern physics course. Graded homework for algebra-based electromagnetism and modern physics courses.

College of the Redwoods Eureka, CA
Department of Mathematics
- Peer Tutor Aug 2011 – May 2013

Tutored students in an open lab that were enrolled in courses ranging from basic arithmetic to multivariable calculus.

Research Interests

More details (mpross.net)

Gravitational wave astronomy: Compact binary coalescence, Stochastic gravitational wave background, Measurements of Hubble's constant, Black hole populations, Neutron star equation of state

Tests of Gravity: Tests of the inverse square law, Equivalence principle verification, Searches for ultra-light dark matter, Gravitational wave tests of General Relativity

Instrumentation: Torsion balances, Beam balances, Precision angle sensing, Interferometric angle sensing, Gravitational calibration, Seismic isolation

Seismology/Seismic Noise Sources: Rotational seismology, Seismometer tilt contamination, Atmospheric-ground tilt coupling, Newtonian-noise subtraction, Elasto-gravity observation

Selected Publications

Full list (scholar.google.com/citations?user=mj-Ij64AAAAI)

Gravitational Wave Astronomy:

Limits on the stochastic gravitational wave background and prospects for single-source detection with GRACE Follow-On, M.P. Ross, C.A. Hagedorn, E.A. Shaw, A.L. Lockwood, B.M. Iritani, J.G. Lee, K. Venkateswara, J.H. Gundlach - Physical Review D, 2020

GW190521: A Binary Black Hole Merger with a Total Mass of $150 M_{\odot}$, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2020

GW190814: gravitational waves from the coalescence of a 23 solar mass black hole with a 2.6 solar mass compact object, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GW190412: *Observation of a binary-black-hole coalescence with asymmetric masses*, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review D, 2020

GW190425: *Observation of a compact binary coalescence with total mass $\sim 3.4 M_{\odot}$* , R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GWTC-1: *a gravitational-wave transient catalog of compact binary mergers observed by LIGO and Virgo during the first and second observing runs*, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review X, 2019

GW170608: *Observation of a 19 solar-mass binary black hole coalescence*, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review X, 2017

A gravitational-wave standard siren measurement of the Hubble constant, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Nature, 2017

GW170817: *observation of gravitational waves from a binary neutron star inspiral*, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2017

Multi-messenger Observations of a Binary Neutron Star Merger, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- The Astrophysical Journal Letters, 2020

GW170104: *observation of a 50-solar-mass binary black hole coalescence at redshift 0.2*, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2017

Tests of Gravity:

Tests of general relativity with the binary black hole signals from the LIGO-Virgo catalog GWTC-1, R. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review D, 2019

Tests of general relativity with GW170817, B.P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration)- Physical Review Letters, 2019

Experimental Progress Towards Testing the Behavior of Gravity at the 20-micron Distance Scale
Authors - M.P. Ross, J.S. Johnson, I.S. Guerrero, H.F. Leopardi, C.D. Hoyle - Journal of Undergraduate Research and Scholarly Excellence, 2018

Tests of Short-Range Gravity with a Novel Parallel-Plate Torsion Pendulum, M.P. Ross - NCUR Proceedings, 2015

Instrumentation:

A Low-Frequency Torsion Pendulum with Interferometric Readout, M.P. Ross, K. Venkateswara, C.A. Hagedorn, C.J. Leupold, P.W.F. Forsyth, J.D. Wegner, E.A. Shaw, J.G. Lee, J.H. Gundlach - Review of Scientific Instruments, 2021

Precision Mechanical Rotation Sensors for Terrestrial Gravitational Wave Observatories, M.P. Ross - University of Washington, 2020

Particle swarming of sensor correction filters, J.J. Carter, S.J. Cooper, E. Thrift, J. Briggs, J. Warner, M.P. Ross, C.M. Mow-Lowry - Classical and Quantum Gravity, 2020

Observation of a potential future sensitivity limitation from ground motion at LIGO Hanford, J. Harms, E.L. Bonilla, M.W. Coughlin, J. Driggers, S.E. Dwyer, D.J. McManus, M.P. Ross, B.J.J. Slagmolen, K. Venkateswara - Physical Review D, 2020

Quantum correlations between light and the kilogram-mass mirrors of LIGO, Haocun Yu, L. McCuller, M. Tse, N. Kijbunchoo, L. Barsotti, N. Mavalvala, et. al. (The LIGO Scientific Collaboration Instrument Science Authors) - Nature, 2020

Quantum-Enhanced Advanced LIGO Detectors in the Era of Gravitational-Wave Astronomy, M. Tse et al. (The LIGO Scientific Collaboration Instrument Science Authors)- Physical Review Letters, 2019

Seismology/Seismic Noise Sources:

Towards windproofing LIGO: Reducing the effect of wind-driven floor tilt by using rotation sensors in active seismic isolation, M.P. Ross, K. Venkateswara, J. Warner, C. Mow-Lowry, B. Lantz, J. Kissel, H. Radkins, T. Shaffer, R. Mittleman, S. Cooper, A. Pele, J. Gundlach - *Classical and Quantum Gravity*, 2020

Implications of dedicated seismometer measurements on Newtonian-noise cancellation for advanced LIGO, M.W. Coughlin, J. Harms, J. Driggers, D.J. McManus, N. Mukund, M.P. Ross, B.J.J. Slagmolen, K. Venkateswara - *Physical Review Letters*, 2018

Low-Frequency Tilt Seismology with a Precision Ground-Rotation Sensor, MP Ross, K Venkateswara, CA Hagedorn, JH Gundlach, JS Kissel, J Warner, H Radkins, TJ Shaffer, MW Coughlin, P Bodin - *Seismological Research Letters*, 2018

Presentations

In-Vacuum Inertial Rotation Sensors, M.P. Ross - Low-frequency Workshop, Remote. 2021

LIGO NCal Update, M.P. Ross - LIGO/Virgo collaboration meeting, Remote. 2021

Recent Discoveries in Gravitational Wave Astrophysics, M.P. Ross - CENPA Seminar, Remote. 2020

LIGO Newtonian Calibrator, M.P. Ross - LIGO/Virgo collaboration meeting, Remote. 2020

University of Washington LIGO Group Overview, M.P. Ross - Gravitational Wave Astronomy Northwest Meeting, Remote. 2020

Compact-BRS Update, M.P. Ross - LIGO/Virgo collaboration meeting, Warsaw, Poland. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, M.P. Ross - Gravitational Wave Astronomy Northwest Meeting, LIGO Hanford Observatory. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, M.P. Ross - Applied Physics Lab Seminar, University of Washington. 2019

Development and deployment of beam rotation sensors for the LIGO seismic isolation system, M.P. Ross - SeismoLunch Seminar, University of Washington. 2019

Integration of Beam Rotation Sensors to seismic isolation, A. Pele, M.P. Ross - Low-frequency sensing and control for aLIGO workshop, University of Birmingham, United Kingdom. 2018

Beam Rotation Sensor Update, M.P. Ross - LIGO/Virgo collaboration meeting, Sonoma State University. 2018

Tests of Short-range Gravity with a Novel Parallel Plate Torsion Pendulum, M.P. Ross - National Conference on Undergraduate Research, Eastern Washington University. 2015

Experimental Progress on Tests of Gravity at 20 microns with a Parallel-Plate Torsion Pendulum, M.P. Ross - 31st Pacific Coast Gravity Meeting, University of Oregon. 2015

Experimental Progress on Tests of Gravity at 20 microns. M.P. Ross and C. Cardenas - APS Far West Section Meeting, University of Nevada, Reno. 2014
